Louisiana-Pacific Samoa, Inc.

SIMPLIFIED PROCESS NARRATIVE FOR THE SAMOA PULP MILL

Louisiana-Pacific Samoa, Inc. ("L-P") owns and operates a market bleached kraft pulp mill located on the Samoa Peninsula in Humboldt County, California. The Samoa Mill produces approximately 700 tons of bleached or unbleached kraft market pulp per day. In January of 1994, L-P permanently ceased the use of chlorine and chlorine containing compounds in the bleaching process at the Samoa Pulp Mill. The totally chlorine free (“TCF”) bleaching process employed at the Samoa Mill uses hydrogen peroxide and oxygen as alternative bleaching agents to the conventional bleaching chemicals, chlorine and chlorine dioxide. When producing unbleached pulp, the mill does not use any bleaching chemicals in the process.

Once produced, the kraft pulp can either be used directly as brown stock or bleached to produce bleached kraft pulp. L-P markets finished pulp to customers worldwide. They, in turn, use it as the raw material for their own production of paper or paper products.

Regardless of the further processing which may take place, the kraft process involves certain steps which are common to all kraft pulp mills. In all kraft mills, the one feature which makes it economically viable is its chemical recovery process. Without the recovery and conversion of the pulping chemicals back to their original form, the kraft process would simply not be competitive.

For the purpose of this overview of the process, each basic process function will be briefly discussed. Although the end product of the Samoa mill is pulp, it is emphasized that this is only an intermediate step in the manufacture of the final products, which are produced elsewhere by the mill’s pulp customers.

The components of the Samoa Pulp Mill overall operation are shown schematically on the attached drawing and are briefly discussed below.

a) <u>Chip Piles:</u>

At the Samoa Pulp Mill, the wood comes cut into chips about the size of a half dollar. Wood is the basic raw material for making paper and hence, pulp. Wood is a combination of cellulose and lignin. Cellulose is the portion that forms pulp, the lignin is an unwanted by-product, but is important in the energy production at the mill. Therefore, before pulp can be made, the cellulose must be removed from the surrounding matrix of lignin.

b) <u>Digester:</u>

The objective of the pulping operation is to separate the cellulose fibers from the wood. Wood chips are fed from storage into a large pressure cooker called a digester. The purpose of the digester is to dissolve the lignin, which holds the cellulose fibers together in the chips. In the kraft process, this is accomplished by cooking the chips in a water solution of caustic soda (NaOH) and sodium sulfide (Na_2S).

Ideally, the cooking operation would remove all traces of lignin without destroying any fibrous material. In actual practice, some cellulose is destroyed and some lignin remains. The mixture of digested wood chips (now called "brown stock") and used cooking chemicals (now labeled "black liquor"), are discharged from the digester into a blow tank. Since they exit hot and under pressure, some of the liquid flashes. The energy liberated in this part of the process is recaptured by a heat recovery system.

c) Brown Stock Washing:

After leaving the blow tank, the pulp is washed in a series of vacuum filters. The first filter uses wash water from the previous (downstream) filter, and so on. This is the point where the recovery of the spent cooking chemicals begins by capturing the used wash water ("weak black liquor").

Weak black liquor from washing systems usually exits at about 14 to 17% dry solids. In this state, the liquor contains too much moisture for it to burn and the heating value is not sufficient to evaporate the inherent moisture. Consequently, some of the water in the weak black liquor must be removed before it can be injected into the recovery boiler for burning. For discussions sake, the liquor cycle will be reviewed later.

First, let's review what happens to the brown stock after it has been washed. Most of the liquor and non-cellulose material was broken down and removed in the digesting operation, however, some still remains. To remove these impurities the pulp is either washed further in more vacuum filters (unbleached pulp production) or whitened using two oxidation processes in series (bleached pulp production). During the production of bleached pulp, the first oxidation process is oxygen delignification, the second is bleaching. Both perform what chemists refer to as oxidation reactions, but each uses a different method to accomplish it.

d) Oxygen Delignification:

The overall scheme of the oxygen delignification is to blend the brown stock with a caustic soda solution then oxygenate this mixture under pressure and temperature. The result is more of an extended cooking operation than a bleaching phase. The reactants decompose some of the lignin residual which is subsequently captured in a countercurrent washing process. The brown stock becomes somewhat brighter in color due to the removal of lignins.

After the oxygen delignification reaction is finished, the pulp is washed in two sets of washers. The water applied to the second post-oxygen washer is actually the wastewater generated by the bleaching process discussed below. From here, the water is then used on the first post-oxygen washer and then becomes the wash water applied to the final brown stock washer. This counter current washing results in maximum chemical recovery and minimum loss of lignins to the environment.

e) Bleaching:

After being washed, the somewhat whitened brown stock is bleached in a **TCF** bleach plant. The pulp is bleached in five stages with various combinations of oxygen, hydrogen peroxide, and sodium hydroxide. One or two chelation stages are used in combination with the peroxide bleaching stages to remove low levels of transition metals in the pulp, such as manganese and iron, that may interfere with peroxide bleaching. Under controlled conditions, this technique selectively attacks the remaining lignin without noticeable degradation of the cellulose fibers.

The main feature of TCF bleaching is that no chlorine, chlorine dioxide, or other chlorinated species are used in the process. This allows the most of the wastewater to be recycled through the oxygen delignification system and the brown stock washers to the digester. Ultimately, the wastewater components become part of the black liquor recovery cycle and incinerated in the recovery boiler.

f) Pulp Machine:

The whitened pulp from the bleaching process or unbleached pulp from the pulp washers is then processed into the stock used for paper and other product manufacture. A continuous pulp sheet is formed on a large screen and then pressed to removed most of the water. After pressing, the pulp sheet enters a drying section, where the pulp fibers begin to bond together as steam heated rollers compress the sheet. The dry pulp sheet is then cut and baled for shipment.

g) Multiple Effect Evaporators and Concentrator

Now let us return to trace the path of the weak liquor leaving the brown stock washers. With the weak liquor about 85% water, a substantial amount of water must be removed before it can be injected into the recovery furnace. Conventional multiple effect evaporator design limits them to producing solids of no more than 50 to 55%, by weight. Delivering black liquor at these concentrations to a low-odor style recovery boiler is not practical. A high solids concentrator is used to take the liquor up to concentrations that can be fired economically in the new recovery boiler. The net result of this scheme is that 70% solids black liquor is made available to the recovery boiler.

h) Steam Stripping

During the digesting operation, the reaction of caustic soda on some of the resins in the wood produces chemicals in the same family as common house-hold soap. There are also turpentine, methanol and a few other liquid hydrocarbon compounds in black liquor. These latter compounds boil off with the water removed in the final one or two evaporator effects, and are known as "foul condensates." They contain the majority of the substances which cause the effluent to have a characteristic odor. These "foul condensates" also contain methanol which contributes to the mill's BOD. L-P operates a steam stripping system to remove these substances from the condensates, allowing the water to be available for reuse. The products removed by steam stripping are incinerated.

i) Recovery Boiler

The recovery boiler is the first major step in regenerating the cooking liquor used in the digesting phase. This concetrated black liquor is sprayed into the recovery furnace and the organic components burn. The heat produces steam, which is used to produce electricity. Finally, the steam is used throughout the process. The inorganics, remnants of the original cooking liquor, melt and chemically react. The remnants of the sodium sulfide are reduced back to sodium sulfide. The remnants of the caustic (NaOH) are converted to sodium carbonate. These molten chemicals or "smelt" then pour out of the bottom of the recovery furnace where they are mixed with water or "weak wash" in the dissolving tank. The resulting solution is green in color and consequently is given the name "green liquor." The green liquor is pumped out of the dissolving tank to the causticizing area for further processing.

j) Causticizing Area

Contaminant solids, called dregs, are removed from the green liquor, using a green liquor filter. Lime (calcium hydroxide) is now added to the purified green liquor and the two ingredients react, producing the desired sodium hydroxide and an insoluble precipitate, calcium carbonate. Calcium carbonate found in nature is called limestone, we call it “mud.” A clarifier is used to separate the mud and a clear liquid is decanted off the top. This clear liquid referred to as “white liquor” now has the active ingredients it needs to be sent to the digester to start the cycle over again and pulp more wood chips.

To help minimize the amount of chemicals lost from the overall pulping circuit, the calcium carbonate is washed to remove and dilute any white liquor in it. This rinse water, labeled “weak wash,” is recycled by sending it back to the recovery area where it ultimately will be used to dissolve more smelt for the production of green liquor. The calcium carbonate is then converted to calcium oxide (lime) in a rotary kiln and the lime is then available for reuse.

k) Wastewater System

The Samoa mills approach to environmental compliance is unique to the North American pulp industry. Specifically, the mill relies almost exclusively on pollution prevention and best management practices (“BMP”) to comply with environmental requirements. This is in contrast to the industry standard practice of operating large secondary wastewater treatment plants. The main features of the Samoa mill’s environmental management program are the TCF bleaching process with wastewater recycle, steam stripping, and extremely tight control regarding pulping liquor or chemical spills.

The pH of the mill’s effluent is adjusted as needed with sulfuric acid or sodium hydroxide prior to discharge. The mill discharges approximately 15 million gallons per day of wastewater to the Pacific Ocean through a submerged diffuser located approximately 8,200 feet offshore.